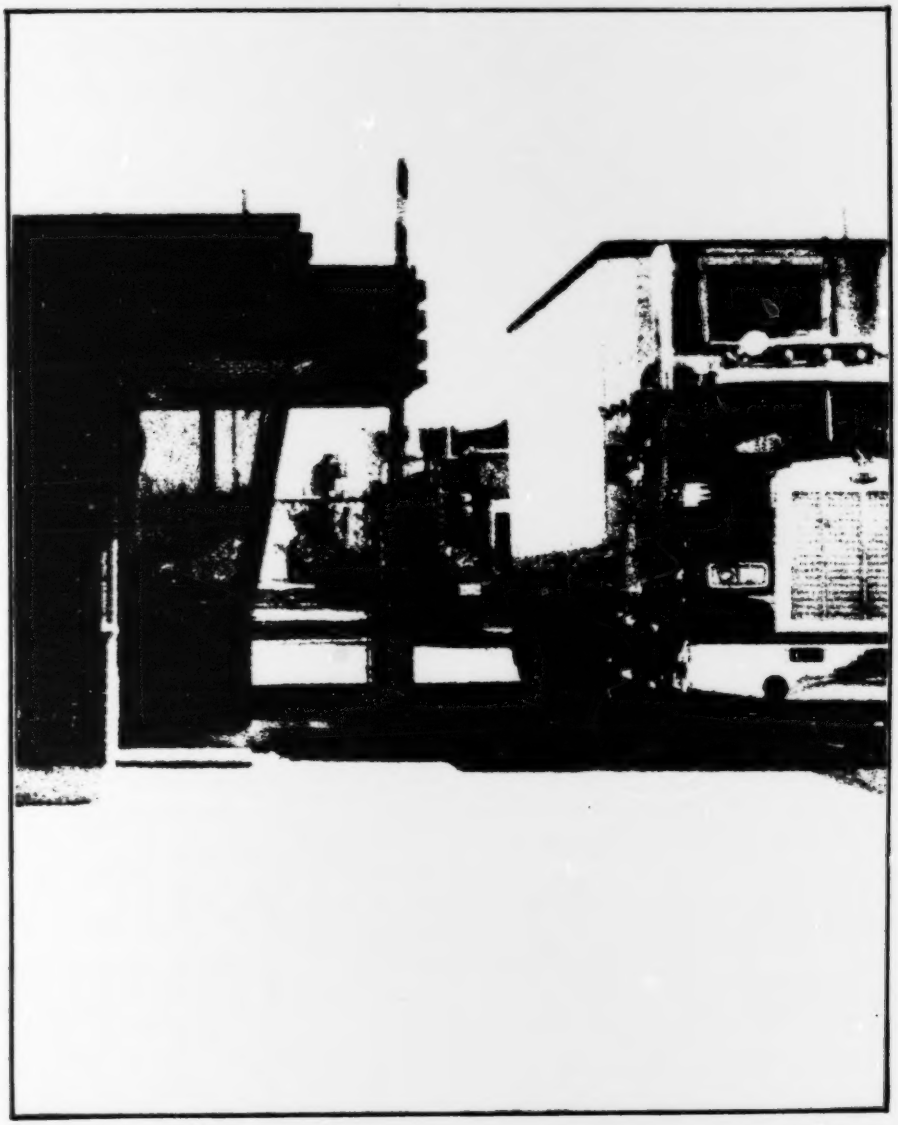
TRE-81-06

Truck Compliance Rates

Truck Inspection System Study



Ontario

Ministry of
Transportation and
Communications

Policy
Planning and
Research Division

TRUCK COMPLIANCE RATES:
TRUCK INSPECTION SYSTEM STUDY

TRE-81-06

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October, 1981.

FOREWORD

This report is one in a series of fact-finding projects in the study of the Ontario Truck Inspection System. The other projects deal with violation profile, inspection efficiency and the behavioural/economic factors in compliance.

The following investigation report provides an estimate of the extent of non-compliance with Ontario's trucking regulations. It is difficult to get a true reading of non-compliance due to data limitations, complexity of truck travel patterns, truckers' behaviour (detection avoidance) and cost constraints. Hence, the statistics presented in this report should be interpreted with a degree of caution, recognizing that this is a first-cut effort.

Richard Slocum
Study Director
October, 1981

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H.C. Pang
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1/ EXECUTIVE SUMMARY

1.1/ Purpose

This study is one component of the Truck Inspection Evaluation. It was undertaken to provide an estimate of the truck regulation non-compliance rate on King's Highways in Ontario.

1.2/ Approach

Special surveys (at 24 truck inspection stations and 23 mobile locations) were carried out in the summer of 1980. Historic reported violation rates, previous truck survey data and traffic information were also examined. These information sources were used in the estimating process and for general comparison.

1.3/ Findings

- Province-wide non-compliance was estimated to be 6.4%. The non-compliance rate for "other" violations was higher than that for "overload" violations (4.5% and 1.9% respectively).

- Regional estimates of non-compliance indicated that Northwestern Region had the highest non-compliance rate (8.8%) followed by Eastern Region (8.3%), Northern Region (7.4%), Southwestern Region (6.4%) and Central Region (4.7%). In every region, the non-compliance rate for "other" violations was higher than that for "overload" violations.

- The estimated non-compliance rate on freeways was lower than that on other King's Highways (4.7% vs. 8.4%).

- The non-compliance estimates from mobile sites and fixed stations on other King's Highways were of similar magnitude (8.0% vs. 8.6%).

- Expressing non-compliance in terms of the truck kilometres travelled in violation of truck regulations, it was observed that Central, Eastern and Southwestern Regions collectively represented about 77% of

the total truck kilometres travelled in violation of truck regulations. The total truck kilometres travelled in these regions is 82% of the provincial total.

- Approximately 40% of the total truck kilometres travelled in violation were on freeways and about 60% were on other King's Highways. The corresponding total truck kilometres travelled was 55% on freeways and 45% on other King's Highways.

- There was insufficient evidence to support the conjecture that the non-compliance rate was higher during evening hours or during the first two hours of a shift upon opening of a station.

- Based on a limited survey, there was some indication that bypassing of inspection stations to avoid detections did occur, suggesting that the estimated non-compliance rate could be higher.

- The 1980 non-compliance rates estimated in this study were significantly higher than the historic reported violation rate (about three times higher, 6.4% vs. 2%).

- Based on additional data analysis (in conjunction with 1978 MTC Truck Survey Data), the following truck characteristics at stations were found to have a significant influence on non-compliance rates ("overload" and/or "other" violations):
  a) type of commodity (e.g., gravel, lumber);
  b) place of registration (e.g., in Ontario, in other provinces);
  c) carrier type (e.g., private, P.C.V.);
  d) trip type (e.g., seasonal, regular);
  e) truck mean travel distance (between origin and destination);
  f) presence of empty trucks.

- A rudimentary prediction model was developed to predict non-compliance on any link of the highway system. Due to data limitations, however, it is suggested that further development is required before using the model.

- Based on origin-destination data, it was shown that there was a potential for repeat inspections. For example, 4% of the trucks

passing through the Windsor South Inspection Station could conceivably have been inspected up to five times upon reaching the Curry Hill Station.

1.4/ Cautions and Limitations

The statistics presented in this report should be interpreted with a degree of caution, recognizing the limitations of the data and the complexity of truck travel patterns on the provincial highway system. In general, there are five areas where limitations in the data exist and where caution should be exercised. These areas include the use of historic reported violation rates, truck volumes, truck station characteristics, the estimating method, and the bypass situation.

1.5/ Suggested Improvements in Estimating Non-Compliance

The following suggestions would lead to improvements in estimating non-compliance.

- The data base can be improved by developing consistent reporting and monitoring procedures: reporting could be made more consistent by a clearer definition of the number of "inspected" trucks; and monitoring by conducting surveys (similar to Special Surveys, 1980) periodically (e.g., once every three years). These procedures could assist in the evaluation of changes to various factors (e.g., enforcement level, regulation, etc.) which may affect non-compliance.

- The developed compliance estimating method and the truck traffic information should be refined and improved.

- A comprehensive examination should be made of the relationship of compliance with truck characteristics, economic factors and behavioural factors including attitude and general practice of shippers, operators, drivers, inspectors and judges.

- An in-depth investigation of the problems of trucks bypassing truck inspection stations should be carried out.

2/ INTRODUCTION

2.1/ Study Background

Throughout the province, truck inspection stations are located on various major highways as one of the means of monitoring and enforcing the truck regulations as prescribed by different acts, namely, Highway Traffic Act, Public Commercial Vehicle Act, Public Vehicle Act, Ontario Highway Transport Board Act, and Motor Vehicle Transport Act (Canada). In general, the primary purposes of these regulations are to improve safety on highways, to minimize the damage done to roads and bridges as a result of overweight vehicles, and to regulate competition in the trucking industry in order to foster a viable Ontario industry. The Drivers and Vehicles Administration of the Ministry of Transportation and Communications is responsible for enforcing these regulations.

There are 50 fixed truck inspection stations located in the five highway carrier regions and 13 districts. The locations of the permanent truck inspection stations are illustrated in Table 1 and Figure 1. It should be noted that two of the 50 stations illustrated (Chatham and Wyoming in the Windsor district) were closed down in 1979. Four stations opened in the last two years, including Wasi (North Bay district), Cassleman (Ottawa district), and Sarnia North and South (sometimes called Plympton North and South) in the Windsor district.

The operation at the truck inspection station is usually scheduled during normal working hours, from 08:00 to 16:00 hours on weekdays. Vehicle inspection stations are periodically opened at other times in order to inspect vehicles avoiding this time period. In certain locations in the province, usually where there are no truck inspection stations, the Ministry utilizes mobile inspection units. The mobile truck inspections are not conducted on a regular basis. Truck inspectors generally look for irregularities in documents, vehicle equipment problems, and overweight infractions.

In 1979, a proposal was put forth to undertake an evaluation of the Truck Inspection System. This arose as a result of the identification of four basic problem areas.

1/ Violations	- Trucks frequently violate regulations. - Violation may or may not be intentional. - The true compliance rate is not known.
2/ Incomplete Enforcement	- The trucking industry has expressed concern about selective enforcement or lack of enforcement in some locations. - Some trucks avoid the normal operation period at truck inspection stations. - Trucks bypass some truck inspection stations. - There is a lack of full, round-the-clock inspection on all routes.
3/ Insufficient Inspection Facilities	- At many locations, facilities and resources are inadequate to handle very high truck volumes. Trucks in violation may have to be waved off without inspection. - The use of mobile inspection units provides insufficient inspection.
4/ Administration	- There is a lack of comprehensive guidelines and plans for development of inspection resources to achieve desirable levels of compliance. - There is no optimum enforcement strategy.

This component of the Truck Inspection System Evaluation was undertaken with the purpose of generating regional and provincial estimates of non-compliance. The scope of this study was restricted to the estimation of non-compliance rates. It did not address the effect on non-compliance of certain factors, such as efficiency of the inspection system, behavioural factors, application and simplicity of the law, and economic cost and benefits to the truck operators. The findings obtained in this study will provide preliminary estimates of non-compliance that may be used with findings obtained in other components of the Truck Inspection System

Study to obtain an overall assessment of the truck inspection system program. These components include profiles of truck regulation violations, and behavioural, economic, and operational studies.

2.2/ Purpose

The purpose of this study is to provide an estimate of non-compliance with truck regulations on King's Highways in Ontario. The study will improve our understanding of the current non-compliance situation, and the findings may be used in subsequent studies to evaluate alternative enforcement strategies.

2.3/ Report Organization

Chapter 3 of this report outlines the study approach. It provides a description of the general philosophy of the approach and outlines the study program.

Chapter 4 provides a detailed description of the study activities; Chapter 5 contains the findings; and Chapter 6 describes some suggested improvements in estimating non-compliance.

3/ STUDY APPROACH

3.1/ General Philosophy

It should be pointed out that this study represents a "first cut" effort at estimating non-compliance. The intent was to become familiar with and utilize the existing available data in deriving these estimates. In examining the data, certain deficiencies and limitations were encountered. This necessitated the acquisition of new data. In an effort to minimize the cost and time elements in acquiring new data, however, an attempt was made to make use of available relevant data wherever possible. The acquisition of new data was made under the constraint of utilization of existing manpower. The surveys were conducted in ways which would minimize disruptions to the system.

3.2/ Study Program

The first phase in the study program was to examine the existing available data and assess their limitations. The following steps were undertaken in this phase.

- Literature was reviewed, and selected outside agencies were contacted.

- Historic records of violations and inspections were reviewed, i.e., historic reported violation data.

- Existing traffic volume information was examined.

- Available data on truck characteristics from previous surveys were gathered and examined.

- The numbers of truck kilometres travelled in various districts and regions were derived from different data sources.

- A road network was developed to represent the provincial highway system. This provided a framework for storing relevant information.

Because of the limitations of the available data, supplementary surveys were designed and initiated to obtain more reliable data. These surveys included:

- special surveys to measure non-compliance at selected fixed inspection stations and mobile locations;

- regular surveys using current inspection procedures to determine the detection rates on a consistent basis across the province;

- an examination of the degree of inspection station bypassing.

The following chapter provides a detailed description of the data sources and analysis.

4/ DESCRIPTION OF DATA SOURCES AND ANALYSIS

4.1/ Existing Data Sources

4.1.1/ Literature Search and Agency Contacts

A computer literature search of the TRIS file revealed that very little is published on the compliance of trucks with the commercial vehicle weight and licensing regulations. Searches of other sources of behavioural material, including psychological abstracts and social science citations, failed to turn up any relevant material. The method of estimating truck compliance with regulations was discussed with a number of other provincial and American state agencies in Alberta, Texas, Nevada and Georgia. There was no indication that these agencies had attempted, or knew of any agency which had attempted, to estimate non-compliance rates of trucks with commercial vehicle weight and licensing regulations. Consequently, there were no examples to draw on to assist in the design of the study.

4.1.2/ Review of Historical Data

A review of the historical data was undertaken by:

- observation of truck inspection stations and discussions with highway carrier staff;

- review of historic records kept by highway carrier staff.

Most truck inspection stations keep a log book or diary in which the inspectors record, on a daily basis, the number of vehicles examined and the number of violations by type (overloads or other infractions). Records were obtained, where available, from all highway carrier districts in the province for the fiscal years 1978 and 1979 and for the summer periods in 1978 and 1979.

Discussions with the inspection staff indicated that, in most cases, the number of vehicles reported examined in the reports and station logs was the number of trucks observed entering the station. Some of these trucks were given a very cursory examination due to high volume and insufficient manpower.

It was observed that, because of other duties, the inspectors have a difficult time keeping a count of vehicles entering the station, and in most cases the number of trucks entering the station is higher than that reported examined. Also, there is some variation in procedures between inspectors so that the definition of the number of vehicles inspected may vary compared with the number of vehicles entering the station.

The number of violations recorded accurately reflects the number of charge reports submitted. There may, however, be some variation between stations and inspectors in the ratio of violations submitted for further investigations to summonses issued, particularly for other (non-overload) violations. This reflects the approach and experience of the individual inspector.

In general, it was felt that there was a need for a more systematic procedure in recording vehicles inspected and violations reported, for use by inspectors in various districts across the province.

4.1.3/ Traffic Volume

Truck volumes on an average summer weekday in 1979 were estimated for every link in the highway network, as a function of the total summer average weekday traffic (SAWDT) (cars and trucks) and the percentage of commercial traffic. This information was obtained from classification counts, as part of the regular program of traffic counting undertaken by the Ministry of Transportation and Communications.

For purposes of this study, the 1979 truck volumes (SAWDT) are assumed to be approximately the same as the 1978 and 1980 truck volumes. The master traffic volume computer file maintained by the Traffic Characteristics Section of the Provincial Roads Planning Office contains traffic and accident data for the last 10 years. Local variations in volume along a section of highway tend to be greater than any change in volume from one year to the next.

Measuring traffic flows in Ontario is a major task. Systematic samples of existing traffic flows are obtained throughout the year, and the traffic volumes on this file are calculated from them using accepted

mathematical models. It should be emphasized that the values given are estimates based on these samples taken throughout the year, and that each section is actually counted only once every three years. Extensive, continuous counting would be both unmanageable and prohibitive in cost. The two-way truck volumes on the network are illustrated in Figure 2.

4.1.4/ Trucking Information From Previous Surveys

1978 Truck Survey

A need was identified , at the beginning of the study, for a source of information on trucking activity, particularly truck characteristics which might be related to compliance, and truck origin-destination patterns.

An excellent source of information on truck activity is the 1978 Ontario Commercial Truck Survey by MTC's Modal Studies Section, Economic Policy Office. This survey was carried out from May to November in 1978. Inspectors interviewed 9666 truck drivers at 37 truck inspection stations.

The survey provides a good overview of trucking activity in the province.

Truck Characteristics

For purposes of this study, truck trip records from the 1978 truck survey were cross-tabulated by inspection station to obtain a profile of truck characteristics at each station. These characteristics were expressed as a percentage of the total trucks entering the truck inspection station. Characteristics were selected which were hypothesized to have some influence on compliance. Some typical characteristics are as follows:

- commodity carried,
- place of registration,
- licence type,
- trip type,
- truck mean origin-destination distance, and
- number of empty trucks.

Truck Origins and Destinations

The origins and destinations of trucks were tabulated from the trip records for each truck inspection station. It was felt that origin-destination patterns should be reviewed because of the possible effect on compliance of duplicate inspections.

Origins and destinations outside of the province were recorded to indicate border crossing points, so that trip tables could be built and the trucks assigned to the network. The number of trucks in the 1978 truck study entering a given station was factored to the 1979 SAWDT truck volume which would enter or pass the station.

Potential Duplication of Inspection

Minimum path trees were built and truck O-D tables, for trucks passing through selected inspection stations, were assigned to the network. In this manner, the number of trucks potentially inspected at one station that also passed (and were potentially inspected) at other stations was determined.

The results of this procedure were used in the review of compliance rates at consecutive truck inspections.

Other Truck Surveys

Other sources of information on truck activity were identified at the beginning of this study. These include the following.

- Roadside surveys of trucks undertaken by the Ministry of Transportation and Communications in conjunction with various transportation planning studies collect origin and destination data, as well as other information.

- Classification counts (usually, 8-hour counts) undertaken by the Ministry of Transportation and Communications in conjunction with O-D surveys and other studies are transferred to the highway traffic volume file by the Traffic Characteristics Section as they become available, and were used in this study, as described earlier.

- Twenty-four-hour classification counts are available at permanent counting stations. The hourly distribution of truck traffic at these locations was helpful (in estimating hourly truck volumes), when designing the truck surveys for this study.

- Regional trip tables for trucks, were developed from roadside surveys by the Ministry of Transportation and Communications as part of the regional planning program.

4.1.5/ Highway Network

A number of highway networks have been built over the last few years by the Demand Analysis and Provincial Highway Planning Groups in the Ministry's Policy Planning and Research Division. These networks, built for various transportation planning purposes, were found to be unsuitable for application in this study.

The provincial highway system was, therefore, simulated by a new, computerized road network designed for this study, representing all of the existing King's Highways in Ontario. The network was coded by jurisdiction (highway carrier districts) and road classification (freeway, other highway) to facilitate summarizing truck activity and compliance on individual sections of highway (links in the network) by road class, highway carrier district, region, and province.

The network was digitized so that link information could be plotted on a map by the computer. This method provided an excellent accounting system, capable of storing information about each section of highway (link in the network) such as the road mileage, volume, compliance rate, etc.

4.2/ Additional Data Collection

As indicated previously, the limitation of the existing available data necessitated the acquisition of more reliable data. These data were obtained through the use of additional surveys. Basically, these surveys, conducted during the summer (1980), were conducted to:

- determine the compliance rate of trucks at selected truck inspection stations;

- determine the compliance rate at other "mobile" locations on highways not served by truck inspection stations;
- determine the current detection rates;
- examine the bypass situation at selected truck inspection stations.

4.2.1/ Special Surveys* at Truck Inspection Stations

A program of special field surveys was completed by highway carrrier staff at 24 selected truck inspection stations. The procedure involved using inspectors in addition to the normal station crew, and special sampling procedures, i.e., inspecting every 'nth' truck entering the station. In this way, a systematic random sample of trucks passing a station was thoroughly examined. This procedure overcame the major problems inspectors face at truck inspection stations, namely:

- insufficient time, manpower and space at truck stations to thoroughly inspect every truck that enters;

- high truck volumes which cannot be inspected backing up onto the highway, causing safety problems, and forcing the stations (in regular shifts) to close;

- difficulty in obtaining an accurate count of vehicles entering the station and in defining how many trucks are inspected.

Overall, 20 155 vehicles were inspected at the fixed stations during the special surveys. This represented an average of about 840 vehicles per site.

Records were kept on an hourly basis of the number of:

- trucks entering a station;
- trucks inspected;
- overweight violations;
- other violations.

The stations selected for the special survey are indicated in Table 2, which also indicates the normal manpower used at the stations and the complement used during the special surveys. Examples of set-ups for fixed station inspections are illustrated in Figures 3, 4, and 5.

* A detailed description of the survey is given in Appendix 3.

4.2.2/ Special Surveys at Mobile Locations

In order to estimate compliance rates on highways not covered by permanent truck inspection stations, temporary mobile stations were set up at 23 sites on these highways. Sites were chosen in co-operation with district area inspectors.

Every 'nth' truck passing these sites was inspected in a procedure similar to that at the permanent stations. Portable scales were used to weigh trucks suspected of being overweight. Mobile inspection sites were scheduled to be open for six 3-hour periods, for a total of 18 h. This sample size was smaller than the sample at the truck inspection stations due to the practical limitations of time and cost. These surveys were more costly to perform due to travelling time and expenses. The surveys were carried out during weekdays in daylight hours. Safety considerations prevented surveys from being undertaken at night or during periods of poor visibility.

Overall, 3741 vehicles were inspected at the mobile stations during the special surveys. This represented an average of about 163 vehicles per site.

The sites for the mobile unit inspections are shown in Table 3. An example of the set-up for special mobile inspections is illustrated in Figure 6.

4.2.3/ Regular Surveys

In addition to the special surveys, a system of regular surveys was carried out. These surveys utilized the regular staff and usual procedures. They were administered in order to determine the "detection rates" at truck inspection stations.

Hourly records of trucks entering the station, trucks inspected, and violations detected were kept for both the special surveys and the regular shifts during the summer of 1980 at the truck inspection stations. It overcame the deficiency in the usual reporting system of keeping count of the vehicles entering and inspected. The form used to record this data is shown in Figure 7.

4.2.4/ Bypass Survey

A bypass survey, conducted at six truck inspection stations, consisted of monitoring the licence plates of trucks at interchanges immediately before and after the inspection station, to determine how many trucks left the freeway to avoid the station and immediately returned to the freeway without time to stop for any legitimate delivery. Discussions with the highway carrier staff indicated that this was one of their concerns, and sites were selected in consultation with the highway carrier staff.

Practical constraints of time and cost limited the sample size for this survey. The survey did not cover trucks which deliberately chose routes to avoid stations entirely, or which left the freeway and continued on an arterial route. Compliance on these arterial routes is covered to some extent for the King's Highway by the mobile surveys previously discussed. Compliance on the county road system was not addressed as it was beyond the scope of this study. The six stations monitoring the bypass traffic included Gananoque North and South, Lorne Park, Oakville, King, and Woodbridge. An example of the setup for the Oakville truck inspection station is illustrated in Figure 8.

4.3/ Data Analysis Plan

Existing available data and the additional data obtained in the surveys were combined to create a data base. Techniques such as correlation and regression analysis were undertaken to explore the relationships between violation rates (obtained from the special surveys), characteristics of trucks (obtained from the 1978 MTC truck survey), and the enforcement system.

The independent non-compliance estimates for the selected fixed truck inspection stations in the special survey provided a basis from which estimates from other stations in the province could be made. The relationship between the non-compliance rates from the special survey and the detection rates from the regular survey, as well as the historic reported violation rates were used in the development of regression equations which enabled the derivation of non-compliance estimates for other fixed stations.

The fixed station and mobile site estimates of non-compliance were aggregated. For a district, each of the sites was weighted by truck volume to provide a district estimate of non-compliance. The weighting procedure was undertaken to compensate for locations with high non-compliance estimates and a low volume of truck traffic. Similarly, regional and provincial estimates of non-compliance were obtained by weighting the district estimates by the number of truck kilometres travelled.

5/ FINDINGS

The findings presented in this report should be interpreted with caution, fully recognizing the limitations of the data, estimating process, and complexity of truck travel patterns. In addition, no objective assessment of the "seriousness" of the non-compliance situation has been made, as no judgement regarding an acceptable level of non-compliance has been established.

5.1/ Provincial Non-Compliance

As shown in Table 4, the province-wide estimate of non-compliance was 6.4%. The non-compliance rate for other violations was higher than the non-compliance rate for overload violations (4.5% and 1.9% respectively).

5.2/ Regional Non-Compliance

Regional estimates of non-compliance indicate that Northwestern Region had the highest non-compliance rate (8.8%) followed by Eastern Region (8.3%), Northern Region (7.4%), Southwestern Region (6.4%) and Central Region (4.7%). In every region, the non-compliance rate for "other" violations was higher than that for "overload" violations (see Table 4).

It was observed that there was a large daily variation in estimated non-compliance rates at individual stations: e.g., at Oakville, the mean non-compliance rate was 2.8% with a range of 0.9% to 6.4%. Variation between sites in the same region was often large: e.g., in the Central Region, the mean non-compliance rate at Victoria was 12.4% compared to Oakville, 2.8%.

5.3/ Highway Class

An examination of the non-compliance rate on different classes of highway revealed that the estimated non-compliance rate for fixed stations located on freeways (4.7%) was lower than the estimated non-compliance rate for fixed stations and mobile units on other King's Highways (8.4%).

5.4/ Mobile vs. Fixed Stations

As shown in Table 6, the non-compliance estimates from mobile sites and fixed stations on other King's Highways were of a similar magnitude (8.0% vs. 8.6%). This does not necessarily imply, however, that mobile inspections have a similar effect as fixed stations on drivers with respect to non-compliance. This may be due to the physical location of the sites. Some fixed stations (audit stations) are open only a few days per year. Their effect may be similar to that of mobile inspection stations. The deterrent effects of both mobile and fixed stations is unknown at this point in time. This issue should be considered in subsequent studies of the truck inspection system.

5.5/ Truck Kilometres Travelled

Expressing non-compliance in terms of the percentage of truck kilometres travelled in violation of truck regulations, it was observed that Central, Eastern, and Southwestern Regions collectively represented about 77% of the total truck kilometres travelled in violation of truck regulations (see Table 7). To put this statistic in perspective, the total truck kilometres travelled in these regions is 82% of the provincial total.

5.6/ Truck Kilometres by Highway Class

As shown in Table 8, approximately 40% of the total truck kilometres travelled in violation were on freeways and about 60% were on other King's Highways. In this case, the corresponding total truck kilometres travelled was 55% on freeways and 45% on other King's Highways.

5.7/ Time of Day

There was prior conjecture that non-compliance rates during the night (midnight to 07:00 hours) or in the evening (17:00 to midnight) were higher than during the day (07:00 to 17:00 hours); and that non-compliance was higher during the first two hours of the opening of a station than later in the shift. As shown in Tables 9A and 9B, there was

insufficient evidence in this study to support the conjecture that the non-compliance rate was higher during evening or early morning hours, or during the first two hours of a shift.

5.8/ Bypassing

Based on a limited survey of six stations, there was some indication that bypassing did occur. For most of the stations surveyed during the bypassing survey, no trucks were found to bypass the station. The maximum rate of 2.3% of trucks was found to bypass Oakville in one hour of the survey.

The stations selected were considered by highway carrier staff to have a high suspected rate of bypassing and were all on freeways where there is a good opportunity to bypass. The survey only gives a rough indication of the bypassing problem. The seriousness of the problem and extent to which bypassing occurs province-wide is difficult to assess.

5.9/ Historic Violation Rates

As shown in Table 10, the 1980 non-compliance rates estimated in this study were significantly higher than the historic reported violation rate (about three times higher). This might be due to the randomized procedure carried out during the special surveys.

5.10/ Factors in Non-Compliance

It is acknowledged that there are several factors that contribute to non-compliance. Based on additional data analysis (in conjunction with 1978 MTC Truck Survey Data), the following truck characteristics were found to have a significant influence on non-compliance rates ("overload" and/or "other violations"). (See Table 11).

5.10.1/ Type of Commodity (e.g., Gravel, Lumber)

With respect to non-compliance rates and commodity, an increasing percentage of log, gravel, lumber or stone trucks tends to increase the non-compliance rate for overloads. These are heavy products and this appears

logical. No evidence was found that steel carriers contribute to increase overweight violations, however, even though steel is a heavy material.

Auto carriers are seldom overweight because of the precise nature of the load. As a result, there is some tendency for stations with a high proportion of auto carriers to have a lower violation rate.

In general, commodities tend to have little effect on other violations.

5.10.2/ Place of Registration (e.g., in Ontario, in Other Provinces)

The proportion of trucks registered in Quebec had an effect, tending to increase other (non-weight) violations. It is felt that the impact of trans-border traffic warrants close observation in future studies, such as the study into the behavioural and economic factors of non-compliance.

5.10.3/ Licence Type (e.g., Private, PCV)

There is some evidence that private trucks have less overweight violations.

5.10.4/ Trip Type (e.g., Seasonal, Regular)

It was observed that a high positive correlation existed between the percent of seasonal trips and overloads, and an inverse relationship existed between the percent of regular trips and overloads. The relationship between trip type and commodity should be examined in order to determine which industries are more seasonal in nature and, therefore, more likely to have seasonal overload infractions. The relationship between trip type and other violations was not found to be significant.

5.10.5/ Truck Mean-Distance (Between Origin and Destination)

Study findings also revealed that a relationship existed between the mean origin-destination distance and other violations. In general, the longer the mean origin-destination distance, the greater the likelihood of other violations.

5.10.6/ Proportion of Empty Trucks

Since empty trucks cannot be overloaded and carry nothing that can be contrary to a PCV licence or permit, the distribution of empty trucks is a major determinant of violation rates.

The correlation between non-compliance rate (Special Survey, 1980, violation rate) and the percent of empty trucks at the truck inspection station is significant. The more empty trucks, the less violations.

5.11/ Prediction Model

A rudimentary prediction model was developed to predict non-compliance on any link of the highway for purposes of evaluating enforcement strategies. Following is the basic structure of the developed equation.

$$Y = A - B\ (\%\ \text{empty}) - C\ (\%\ \text{inspected})$$

where Y = predicted violation rate (non-compliance) on a link,

% empty = estimated percent of trucks that are empty on a link, and

% inspected = estimated percent of trucks on that link that are inspected by the highway carrier staff either on that link or a preceding or subsequent link

Equations were developed on the basis of existing data and can be broken down by type of violations (overload, other violations, total violations) and highway class (freeway, other King's Highway). Coefficients of the equations are not given above, as it is felt that further improvements should be made before the equations can be applied. Improvements could be made through the use of better data and consideration of other variables not examined in this study due to limitations in scope. These variables include economic, operational, and behavioural factors.

5.12/ Truck Origin-Destination Patterns

The origin-destination pattern of trucks determines where the truckers go who pass through the inspection stations, and consequently, which routes

are well covered by inspection and which routes are not. It is fairly obvious from looking at the map that long trips on the 401-QEW corridor pass through several stations. Truckers on these routes stand a good chance of being caught if they are in violation of the regulations. On the other hand, there are large gaps on the highway system where there are few inspection facilities, for example, the Kitchener-Waterloo Area.

In the Southwestern Region, a majority of truck trips passing through the inspection stations have origins, or destinations within the region. The remainder are split between the US border crossings and the Central Region. At inspection stations in the Kingston District, on the other hand, most trucks are passing through from Quebec and the USA to the Central Region or vice versa. The Central Region, the urbanized industrial Toronto area, is the origin or destination for most trips.

With respect to the potential for duplication of inspection in the Windsor to Montreal corridor, stations on long distance truck routes have the potential to inspect the same truck several times. Of the trucks passing Windsor South on an average summer weekday, 54% would also pass Putnam, 35% would pass Streetsville South, and a number would be destined for the Toronto area, but 9%, 8% and 4% respectively would carry on through Whitby, Gananoque South, and Curry Hill. (See Table 12).

These figures show the duplication of inspections if the stations were open 24 h a day. In fact, the stations are only open one or two shifts, so that while some trucks may be inspected more than once, others are not inspected at all. It would appear that co-ordination of the shifts along the corridor in a manner similar to the adjustment of traffic signals along an arterial road could yield benefits.

6/ SUGGESTED IMPROVEMENTS IN ESTIMATING NON-COMPLIANCE

The following suggestions would lead to improvement in estimating non-compliance.

- The data base can be improved by developing consistent reporting and monitoring procedures: eporting could be made more consistent by a clearer definition of the number of "inspected" trucks; and monitoring by conducting surveys (similar to Special Surveys, 1980) periodically (e.g., once every three years). These procedures could assist in the evaluation of changes to various factors (e.g., enforcement level, regulation, etc.) which may affect non-compliance.

- The developed compliance estimating method and the truck traffic information should be refined and improved.

- A comprehensive examination should be made of the relationship of the compliance with truck characteristics, economic factors and behavioural factors including attitude and general practice of shippers, operators, drivers, inspectors, and judges.

- An in-depth investigation into the problem of trucks bypassing truck inspection stations should be carried out.

Table 1/ Location of Regions, Districts and Truck Inspection Stations

SOUTHWESTERN REGION

WINDSOR DISTRICT

Windsor North	Hwy. 401 - 1.7 Mi. W. of Int. 3, N. Side
Windsor South	Hwy. 401 - 2.9 Mi. E. of Int. 3, S. Side
Sarnia North	Hwy. 402 - 3 Mi. E. of Cty. Rd. 2, N. Side
Sarnia South	Hwy. 402 - 3 Mi. E. of Cty. Rd. 2, S. Side
Chatham	Hwy. 2 - Kent Road
Wyoming	Hwy. 7 - 1 Mi. W. of Hwy. 21

LONDON DISTRICT

Putnam North	Hwy. 401 - Interchange 25, N. Side
Putnam South	Hwy. 401 - Interchange 25, S. Side

KITCHENER DISTRICT

No permanent stations

CENTRAL REGION

STONEY CREEK DISTRICT

Oakville	QEW - Hwy. 25, N. Side
Fruitland	QEW - Fruitland Road
Fort Erie	QEW - Niagara Road 124
Winona	QEW - Niagara Road 10, S. Side
Bismark	Hwy. 20 - Regional Road 69

MISSISSAUGA DISTRICT

Lorne Park	QEW - Erin Mills Parkway, S. Side
Victoria	Hwy. 10 - Hwy. 7
Streetsville North	Hwy. 401 - Interchange 40, N. Side
Streetsville South	Hwy. 401 - Interchange 40, S. Side
Cooksville	Hwy. 5 - 2 Mi. W. of Cooksville

Table 1 (cont'd)

SCARBOROUGH DISTRICT

Bowmanville	Hwy. 401 - Interchange 76, N. Side
Whitby	Hwy. 401 - 1.4 Mi. W. Hwy. 12, S. Side
King	Hwy. 400 - York Road 11, E. Side
Woodbridge	Hwy. 400 - 2.3 Mi. N. Hwy. 7, W. Side

EASTERN REGION

KINGSTON DISTRICT

Gananoque North	Hwy. 401 - 1000 Islands Parkway, N. Side
Gananoque South	Hwy. 401 - 1000 Islands Parkway, S. Side
Lancaster	Hwy. 401 - Interchange 128, N. Side
Curry Hill	Hwy. 401 - Interchange 128, S. Side
Prescott North	Hwy. 401 - Interchange 116, N. Side

OTTAWA DISTRICT

Glen Tay	Hwy. 7 - Lanark Road
Alfred	Hwy. 17 - 1 Mi. W. of Alfred
Pembroke	Hwy. 17 - W. of Pembroke
Casselman	Hwy. 417 - 1 Mi. W. Hwy. 138, N. Side

NORTHERN REGION

NORTH BAY DISTRICT

Wasi	Hwy. 11 - S. of Hwy. 654
North Bay South	Hwy. 11 - Callander Bypass
North Bay West	Hwy. 11 - Hwy. 11B
Gravenhurst West	Hwy. 11 - Simcoe/Muskoka Boundary
Parry Sound	Hwy. 69 - Hwy. 69B
Huntsville	Hwy. 60 - Muskoka Road 23

Table 1 (cont'd)

TIMMINS DISTRICT

Cochrane	Hwy. 11 - Hwy. 579
Hearst	Hwy. 11 - Kendal/Way Township Boundary
Spragge	Hwy. 17 - Hwy. 108
New Liskeard	Hwy. 11 - Hwy. 65

NORTHWESTERN REGION

SAULT STE. MARIE DISTRICT

Sault Ste. Marie	Hwy. 17 - 5.5 Mi. N. of Sault Ste. Marie

THUNDER BAY DISTRICT

Thunder Bay North	Hwy. 102 - Carl Avenue
Thunder Bay South	Hwy. 11 - Hwy. 17
Red Rock	Hwy. 11 - Red Rock Road

KENORA DISTRICT

Dryden	Hwy. 17 - Hwy. 601
Fort Frances	Hwy. 11 - Hwy. 611
Keewatin	Hwy. 17 - Keewatin West Limits
Red Lake	Hwy. 105 - Hwy. 125
Vermillion Bay	Hwy. 17 - Hwy. 105

Table 2/ Stations Selected for Special Inspections

	Station	High-way	Max-imum Trucks Per Hour	"n"	Usual Man-power	Special Man-power
Central Region						
Mississauga District	Streetsville N.	(401)	300	10	3	5
	Streetsville S.	(401)	300	10	3	5
	Victoria	(10)	90	5	1-2	4
	Lorne Park	(QEW)	400	10	3-4	6
Scarburough District	King	(400)	100	5-10	2	5
	Woodbridge	(400)	120	5-10	2	5
	Whitby	(401)	200	10	3	5
	Bowmanville	(401)	170	10	2	5
Hamilton District	Oakville	(QEW)	400	10	4	6
	Winona	(QEW)	170	5	2	4
	Fruitland	(QEW)	170	5	2	4
	Fort Erie	(QEW)	50	3	1	3
Southwestern Region						
London District	Putnam N.	(401)	150	5	2-3	6
	Putnam S.	(401)	150	5	2-3	5
Windsor District	Windsor N.	(401)	80	3	2	5
	Windsor S.	(401)	80	3	2	5

Table 2/ (Cont'd)

	Station	High-way	Max-imum Trucks Per Hour	"n"	Usual Man-power	Special Man-power
Eastern Region						
Kingston District	Gananoque N.	(401)	120	3	2	6
	Gananoque S.	(401)	120	3	2	6
	Lancaster	(401)	80	2	2	6
	Curry Hill	(401)	80	2	2	6
Ottawa District	Glen Tay	(7)	30	2	1	3
Northern Region						
North Bay District	Wasi	(11)	50	2	1	3
	Callander (North Bay South)	(11)	50	2	1	3
Northwestern Region						
Thunder Bay District	Thunder Bay	(17)	60	3	1	3

Table 3/ Mobile Sites Selected for Special Inspections (1980).

	DIRECTION
CENTRAL REGION	
SCARBOROUGH DISTRICT	
1. Hwy. 7 & Woodbine	2-way
2. Hwy. 7 & 27	2-way
3. Hwy. 35 at Hwy. 115	2-way
4. Hwy. 11 at Bathurst	2-way
MISSISSAUGA DISTRICT	
5. Hwy. 9 (E. of Hwy. 10)	EB only
6. Hwy. 50 (N. of Bolton)	2-way
STONEY CREEK DISTRICT	
7. Hwy. 405, Queeston	WB only
8. Hwy. 6, Flamboro	WB only
9. Hwy. 2 at 403, Brantford	WB only
SOUTHWESTERN REGION	
LONDON DISTRICT	
10. Hwy. 2, Thamesford	EB only
11. Hwy. 3, Courtland	EB only
WINDSOR DISTRICT	
12. Hwy. 40 (at Hwy. 80)	SB
	NB

Table 3/ (cont'd)

	DIRECTION
KITCHENER DISTRICT	
13. Hwy. 27 (N. of Barrie)	NB
	SB
14. Hwy. 6 (Mount Forest)	NB
	SB
15. Hwy. 7 (W. of Guelph)	EB
	WB
16. Hwy. 7 & 8 (E. of Stratford)	EB
	WB
EASTERN REGION	
KINGSTON DISTRICT	
17. Hwy. 138 (at Hwy. 43)	WB
	SB
18. Hwy. 16 (S. of Hwy. 43)	2-way
19. Hwy. 31 (at Hwy. 401)	2-way
20. Hwy. 34 (N. of Alexandria)	NB
21. Hwy. 34 (N. of Hwy. 401)	SB
22. Hwy. 37 (at Hwy. 7)	NB
	SB
23. Hwy. 62 (N. of Belleville)	2-way

Table 4/ Provincial and Regional Estimates of Non-Compliance Rate (1980)

REGIONS	OVERLOAD	OTHER VIOLATION	TOTAL
Central	1.2	3.5	4.7
Southwestern	1.7	4.7	6.4
Eastern	2.9	5.4	8.3
Northern	2.5	4.9	7.4
Northwestern	3.4	5.4	8.8
Province	1.9	4.5	6.4

Table 5/ Estimate of Non-Compliance Rate by Class of Highways (1980)

CLASS OF HWY.	OVERLOAD	OTHER VIOLATIONS	TOTAL
Freeway	1.3	3.4	4.7
Other King's Hwy.	2.7	5.7	8.4

Table 6/ Non-Compliance Estimate from Mobile Sites vs. Fixed Stations on Other King's Highways

TYPE OF LOCATION	OVERLOAD	OTHER VIOLATION	TOTAL
Mobile Sites	1.9	6.1	8.0
Fixed Stations on Other King's Highways	3.5	5.1	8.6

Table 7/ Regional Distribution of Truck Kilometres Travelled in Violation

(Average Summer Weekdays)

REGIONS	TRUCK km ('000) TRAVELLED IN VIOLATION	% OF TOTAL TRUCK km TRAVELLED IN VIOLATION
Central	281	29%
Southwestern	204	21%
Eastern	265	27%
Northern	119	12%
Northwestern	106	11%

Table 8/ Distribution of Truck Kilometres Travelled in Violation by Class of Highway

(Average Summer Weekdays)

CLASS OF HIGHWAY	TRUCK km ('000) TRAVELLED IN VIOLATION	% OF TOTAL TRUCK km TRAVELLED IN VIOLATION
Freeway	389	40.4%
Other King's Highways	575	59.6%

Table 9A/ Comparison of Non-compliance Rates During Daytime vs. Nighttime (Based on 10 Stations from 1980 Special Surveys)

TIME PERIOD	AVERAGE RATE
24:00 - 07:00	4.5
07:00 - 17:00	5.0
17:00 - 24:00	4.9

Table 9B/ Comparison of Non-compliance Rates During the First Two Hours of the Station Operation vs. the Whole Shift (Based on 24 Stations from 1980 Special Surveys)

OPERATION PERIOD	AVERAGE RATE
First 2 h of Station Operation	5.8*
Whole Shift	5.5*

* The difference of the average rates was not statistically significant.

Table 10/ Comparison of Historic Reported Violation Rates with 1980 Estimated Non-Compliance Rate

REGIONS	1978 SUMMER JULY-SEPT.	1979 SUMMER JULY-SEPT.	1980 SUMMER ESTIMATES
Central	0.9	1.3	4.7
Southwestern	2.0	2.9	6.4
Eastern	4.9	2.6	8.4
Northern	2.3	5.5	7.4
Northwestern	4.3	4.8	8.8
Province	1.4	2.0	6.4

Table 11/ Correlations Between Non-Compliance Rates and Truck Station Characteristics

TRUCK STATION CHARACTERISTICS	OVERLOAD 1980	OTHER VIOLATIONS 1980
Commodity		
Percent Log Truck	.66	N.S.
Percent Gravel Truck	.64	N.S.
Percent Lumber Truck	.60	N.S.
Percent Paper Truck	N.S.	N.S.
Percent Steel Truck	N.S.	N.S.
Percent Stone Truck	.87	N.S.
Percent Auto Carrier	-.48	N.S.
Place of Registration		
Percent Registered in West	.71	N.S.
Percent Registered in Atlantic	.64	N.S.
Percent Registered in Ontario	N.S.	-.41
Percent Registered in US	N.S.	N.S.
Percent Registered in Quebec	N.S.	.69
Licence Type		
Percent PCV Truck	.47	N.S.
Percent Private Truck	-.57	N.S.
Trip Type		
Percent Seasonal Trips	.86	N.S.
Percent Regualr Trips	-.60	N.S.
Truck Mean O-D Dist.		
Mean O-D Distance	N.S.	.44
Percent Empty		
Percent Empty Trucks	-.55	-.30

* Truck Station Characteristics were obtained from 1978 MTC Survey.

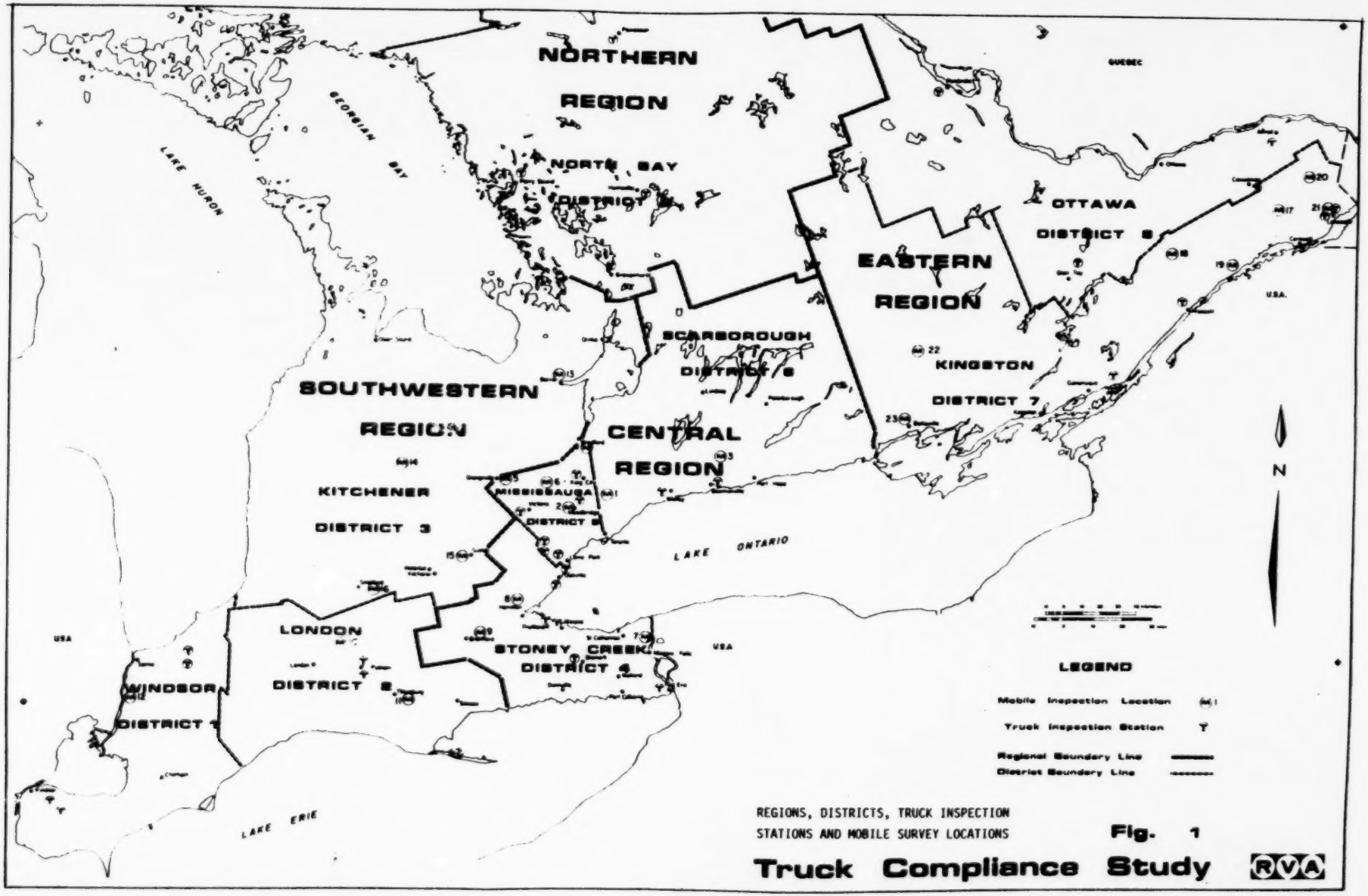
L E G E N D

- Correlation can be positive (+) or negative (-)
- Scale 0.0 Low 1.0 High
- N.S. = Not significant at .05 level

Table 12/ An Illustration of the Potential for Duplication of Inspection

Interviewed at	PASSING THROUGH STATIONS					
	Windsor	Putnam S.	Streetsville S.	Whitby	Gananoque S.	Curry Hill
Windsor South	1157	623	394	106	91	53
	(100)	(54)	(34)	(9)	(8)	(4)

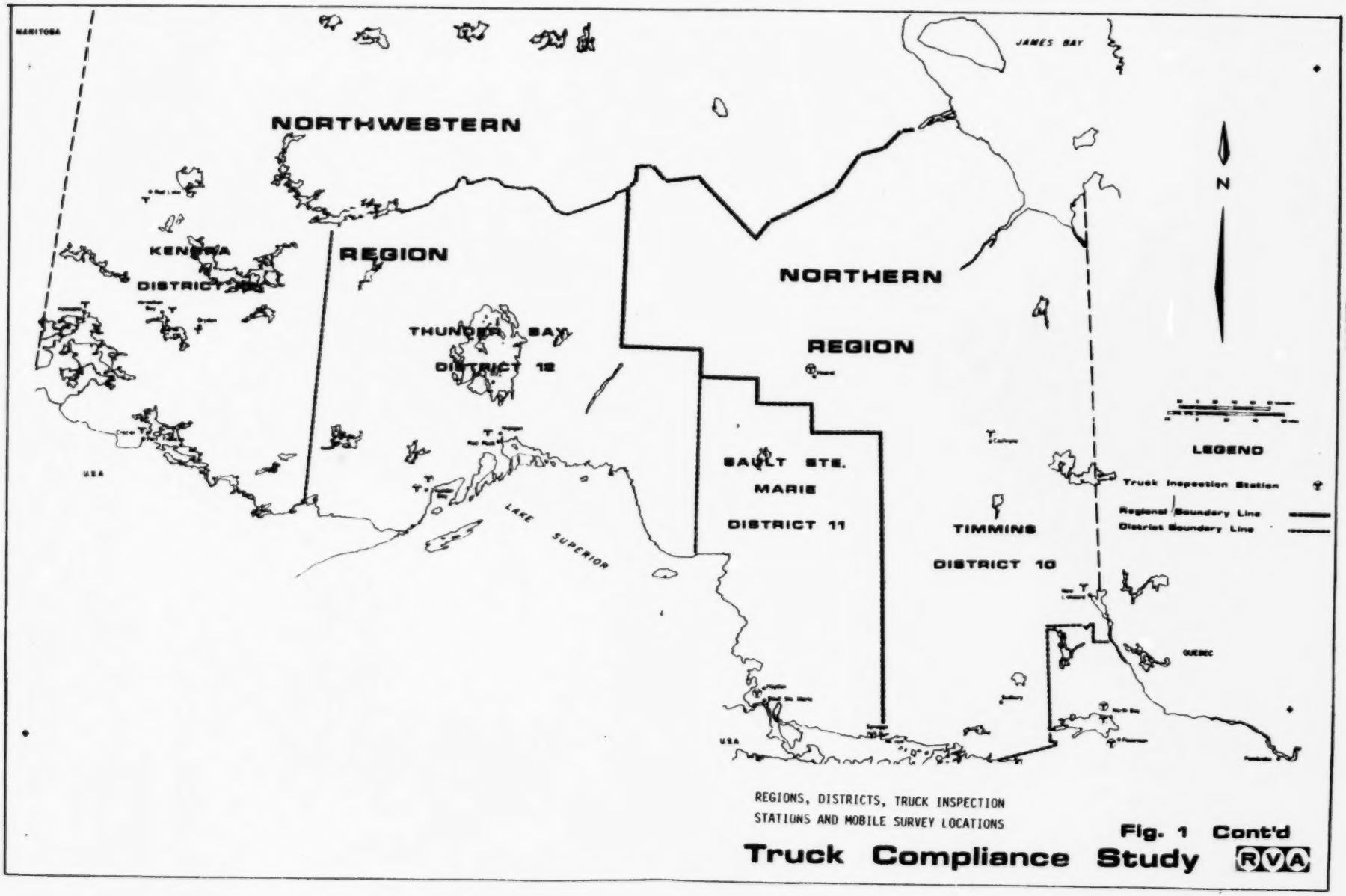
NOTE: Number shown in brackets is percentage of those interviewed.

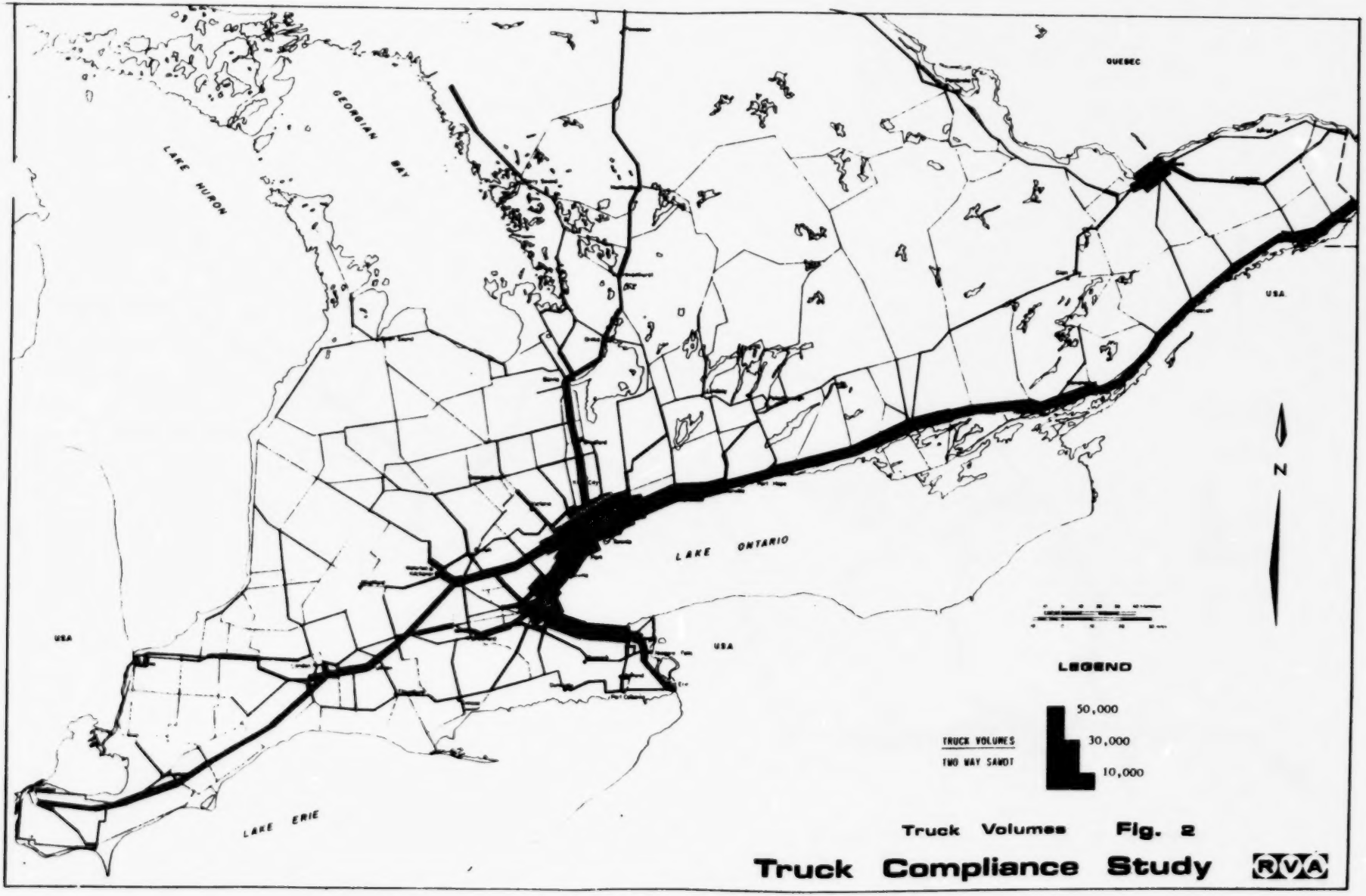


REGIONS, DISTRICTS, TRUCK INSPECTION STATIONS AND MOBILE SURVEY LOCATIONS

Fig. 1

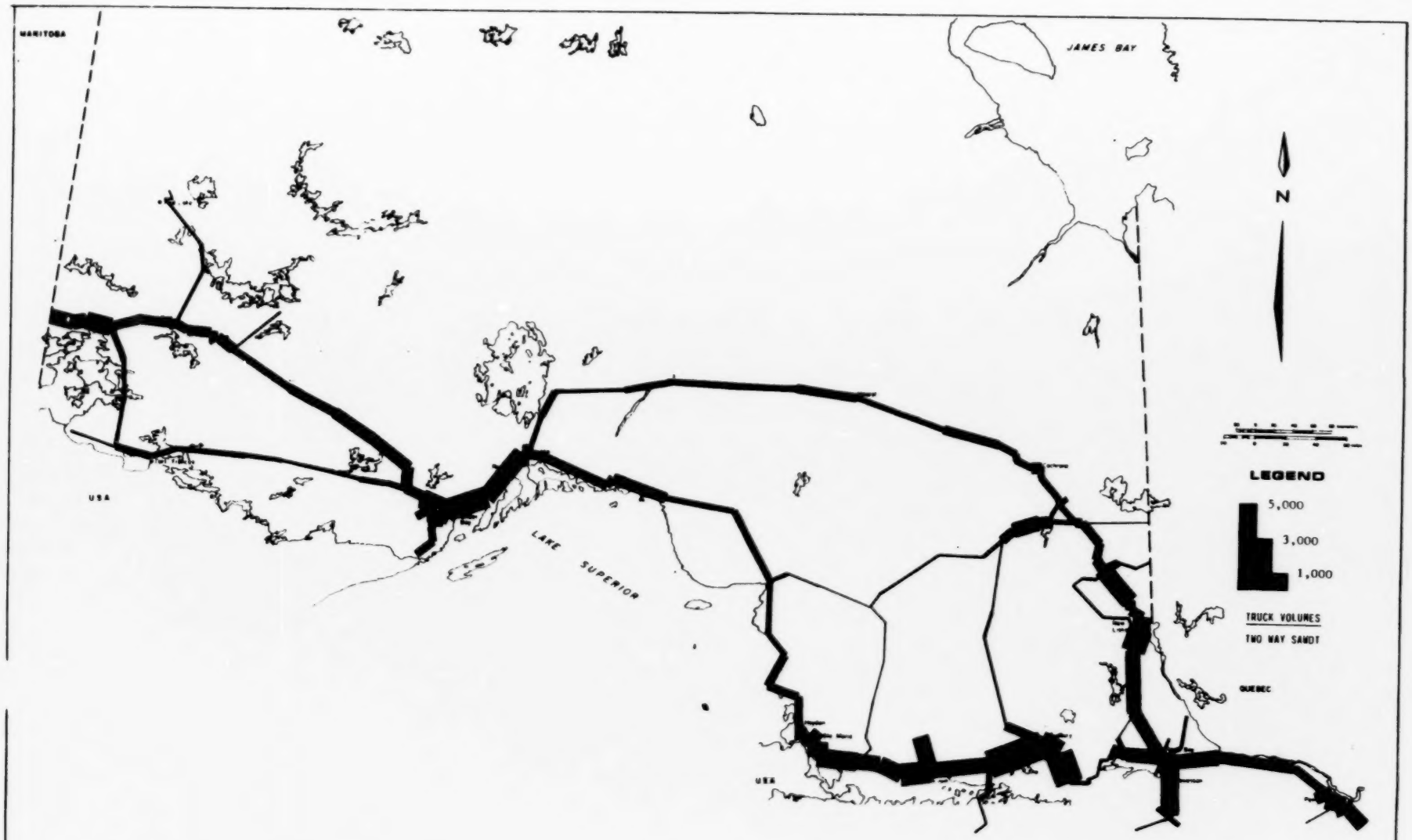
Truck Compliance Study RVA


MANITOBA
JAMES BAY
NORTHWESTERN
REGION
KENORA
DISTRICT
THUNDER BAY
DISTRICT 12
NORTHERN
REGION
N
LEGEND
Truck Inspection Station
Regional Boundary Line
District Boundary Line
SAULT STE.
MARIE
DISTRICT 11
TIMMINS
DISTRICT 10
LAKE SUPERIOR
USA
USA
REGIONS, DISTRICTS, TRUCK INSPECTION
STATIONS AND MOBILE SURVEY LOCATIONS
Fig. 1 Cont'd
Truck Compliance Study
RVA



Truck Volumes Fig. 2

Truck Compliance Study RVA



Truck Volumes Fig. 2 Cont'd

Truck Compliance Study RVA

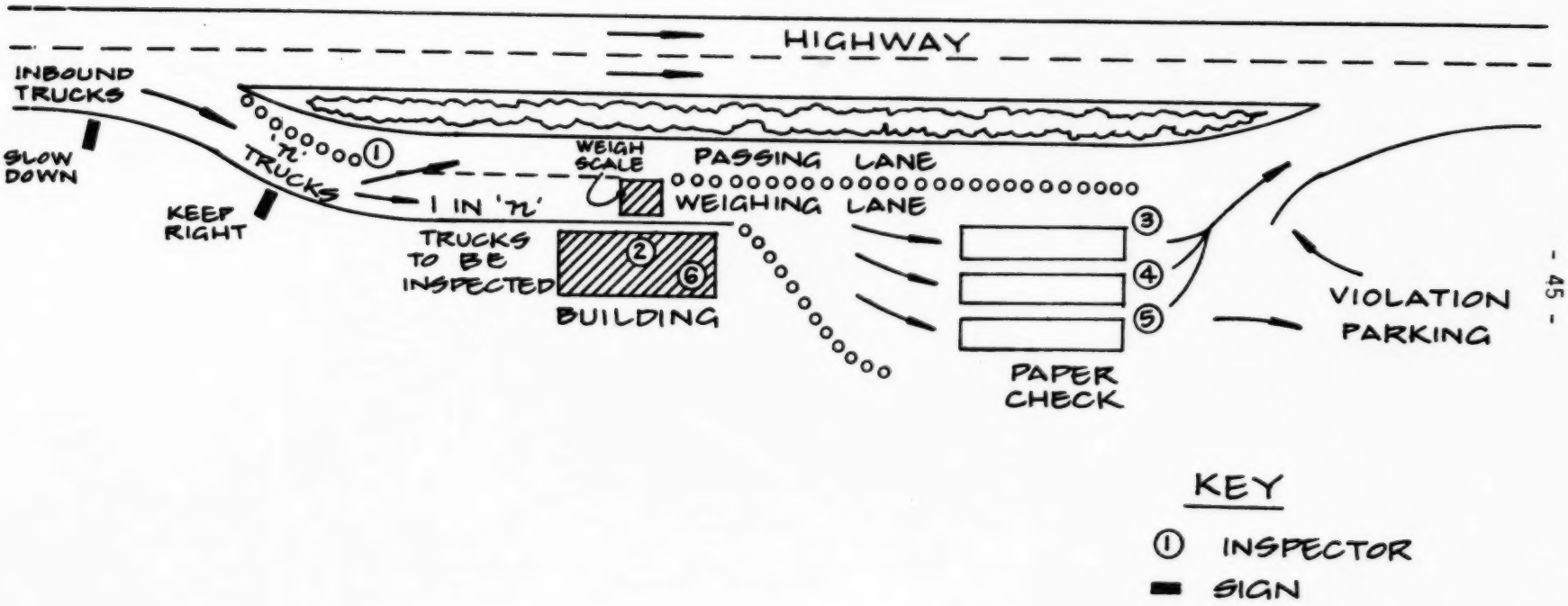


FIGURE 3 EXAMPLE SET UP FOR LORNE PARK

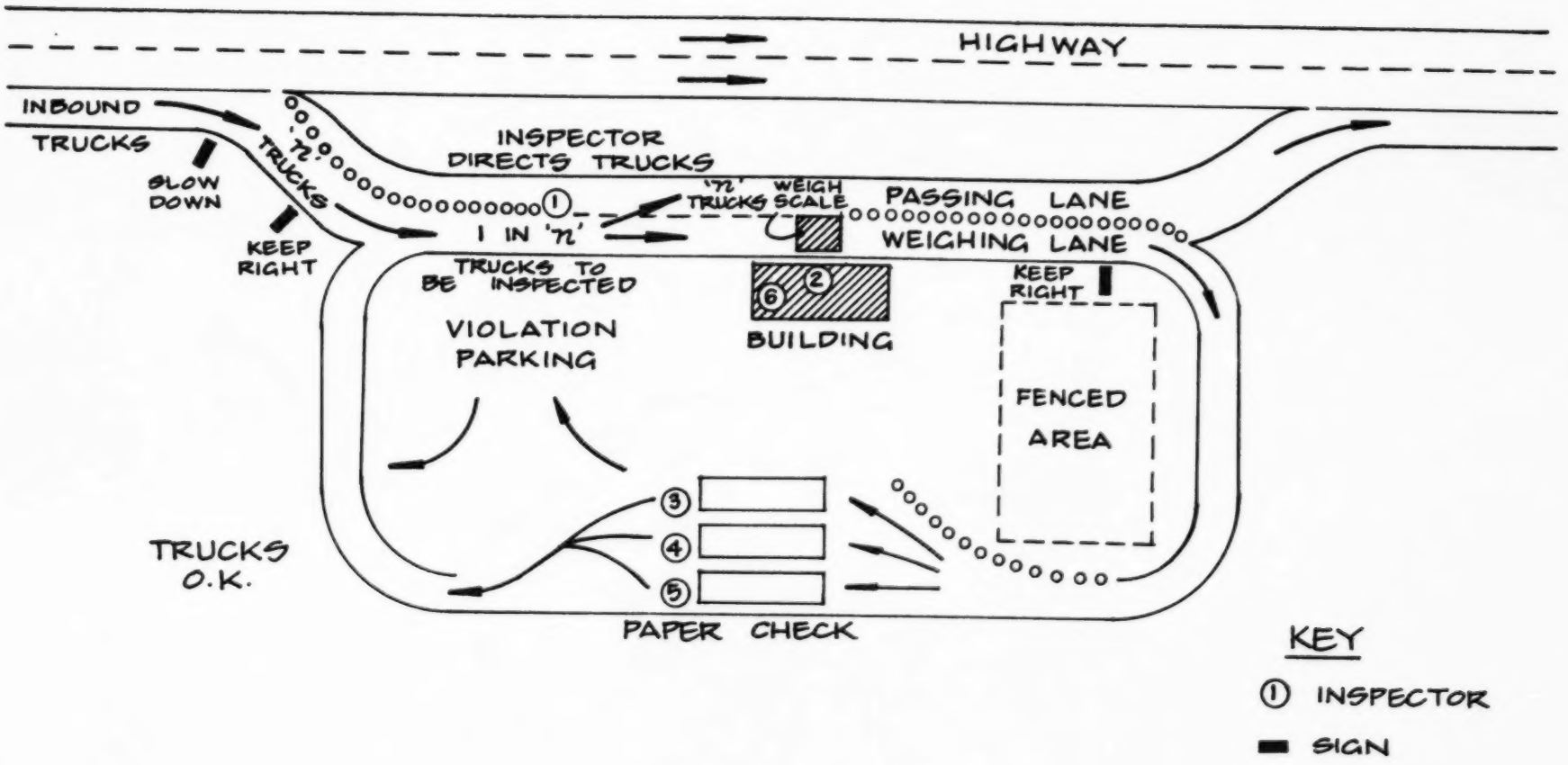


FIGURE 4, EXAMPLE SET UP AT OAKVILLE

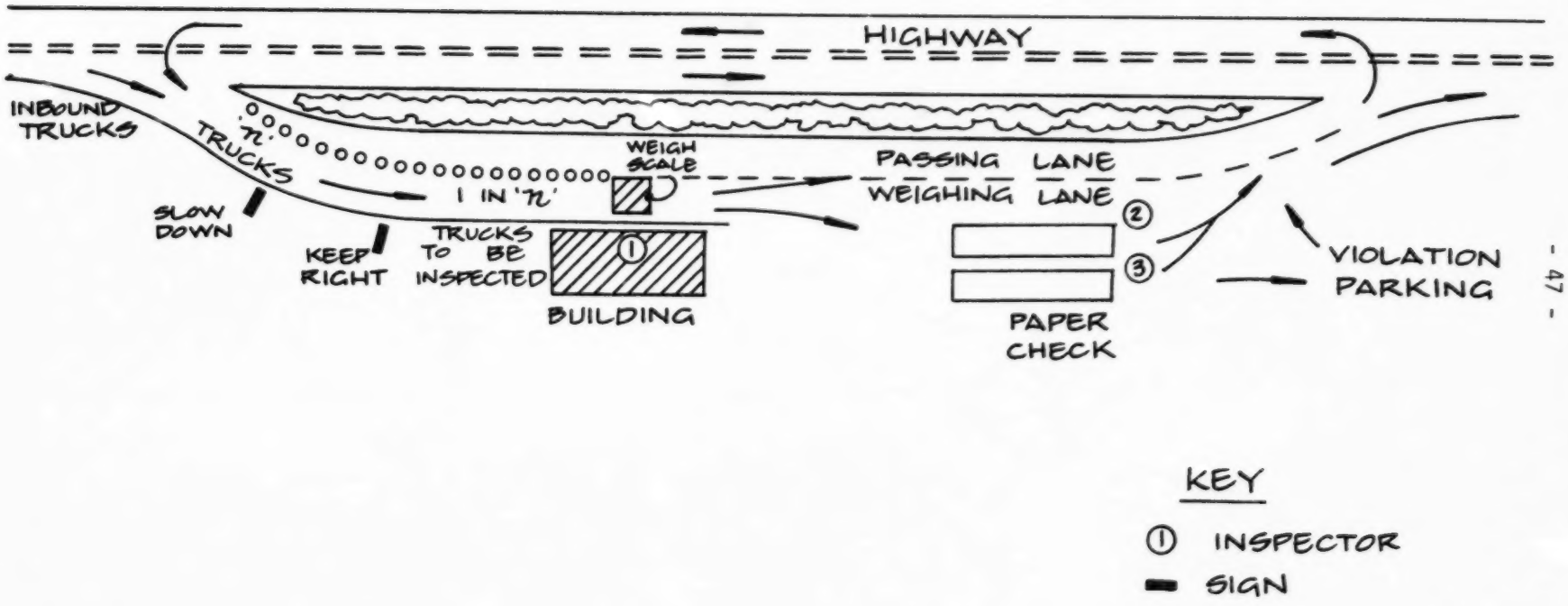


FIGURE 5 , EXAMPLE SET UP AT LOW VOLUME LOCATIONS

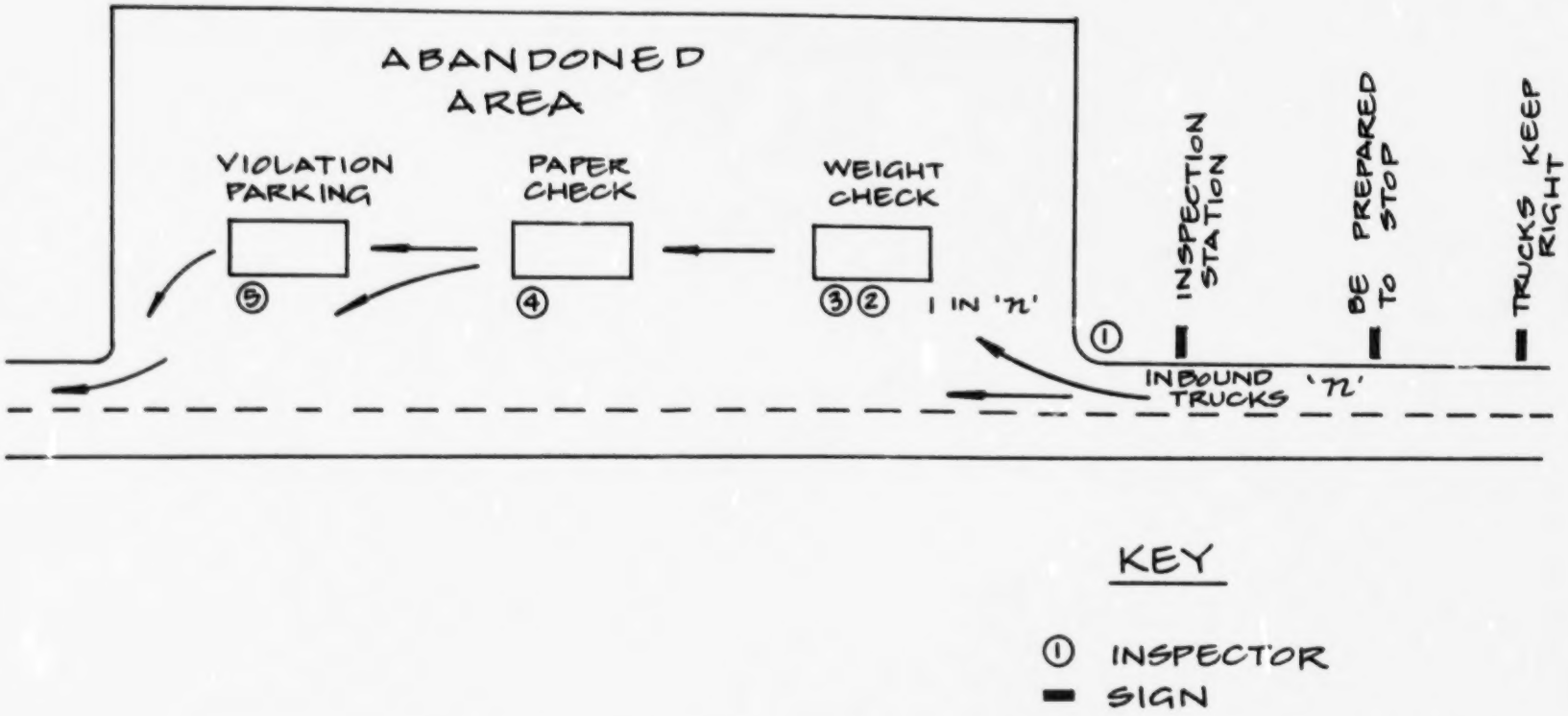


FIGURE 6 , SET UP FOR MOBILE INSPECTION

July and August 1980

Station_____ Day_____ Date_____

Shift Time Start_____ Finish_____ Inspector_____

HOUR	Number of Trucks Entering	Inspected	Overloads	Other Violations
24:00 - 01:00				
01:00 - 02:00				
02:00 - 03:00				
03:00 - 04:00				
04:00 - 05:00				
05:00 - 06:00				
06:00 - 07:00				
07:00 - 08:00				
08:00 - 09:00				
09:00 - 09:00				
09:00 - 10:00				
10:00 - 11:00				
11:00 - 12:00				
12:00 - 13:00				
13:00 - 14:00				
15:00 - 16:00				
17:00 - 18:00				
18:00 - 19:00				
19:00 - 20:00				
20:00 - 21:00				
21:00 - 22:00				
22:00 - 23:00				
23:00 - 24:00				

Remarks (Station closed due to weather, etc.)

Figure 7/ HOURLY RECORD OF INSPECTION AND VIOLATIONS USED IN SPECIAL SURVEYS

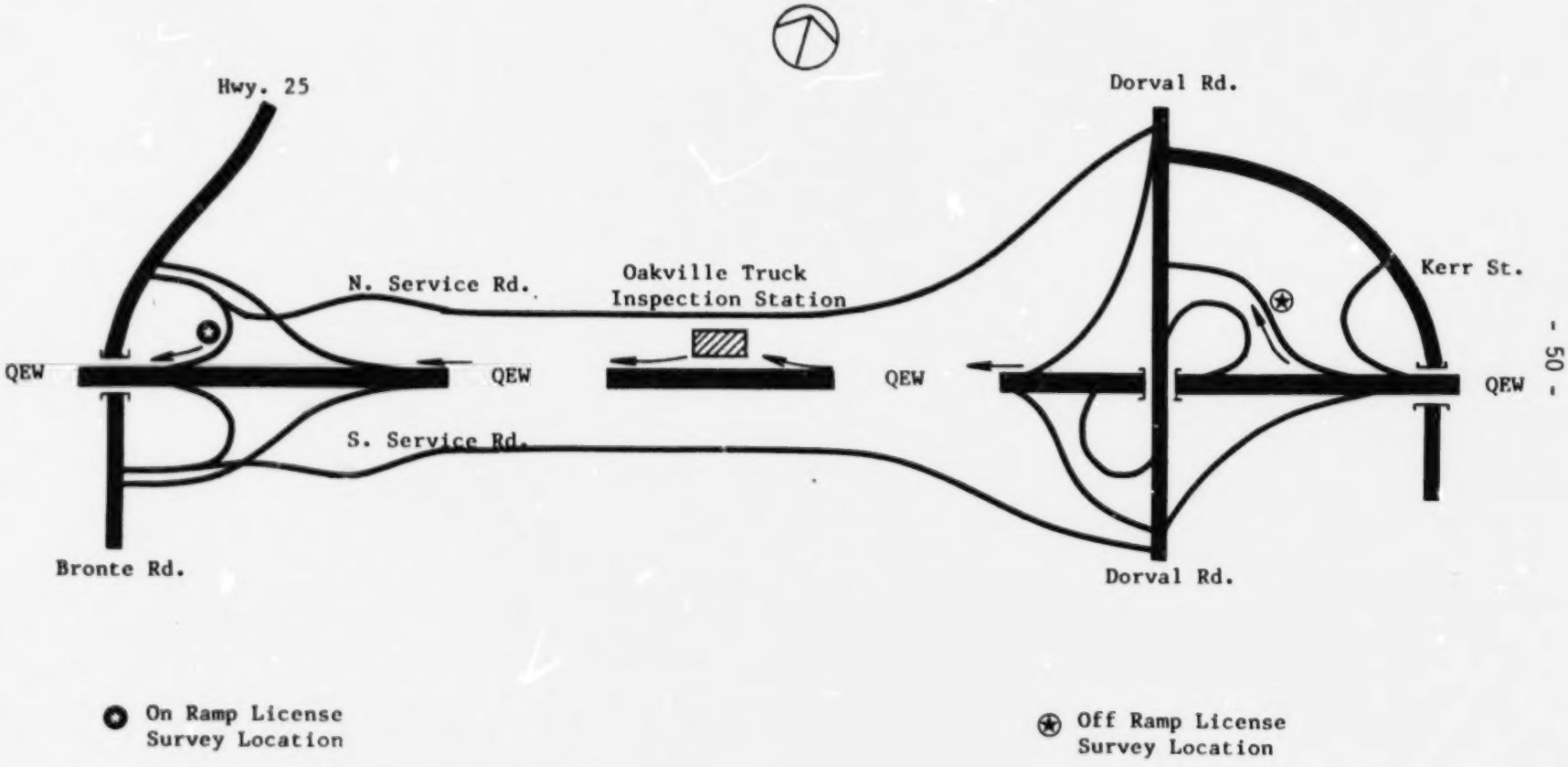


Figure 8/ BYPASS SURVEY EXAMPLE SET-UP FOR
OAKVILLE TRUCK INSPECTION STATION

7/ APPENDIX 1

GLOSSARY

GLOSSARY

Historic Reported Violation Rate: the number of violations per 100 reported truck inspections for a given year prior to 1980

Note: Reported truck inspection is not interpreted consistently among station inspectors. Some may count all the trucks entering the station as the number of inspections. Others may count only the trucks passing through the weighing lane.

Detection Rate: the number of violations per 100 trucks entering a station

Note:
- In this study, special instruction was given to station inspectors for recording the number of trucks entering the station during the regular shifts, summer 1980.
- The detection rates discussed in the report entitled "Truck Regulation Violations" TRE-81-05 are in fact Historic Reported Violation Rates.

Non-Compliance Rate: the number of violations per 100 trucks travelling on a given section of highway for a given period of time

Note: In this study, sections of highway are defined as links on the provincial King's Highway system. The time is taken as an average summer weekday in 1980.

Overload Violation: violations related to weight regulations (e.g., HTA Section 72, axle unit weight violation)

"Other" Violations: violations related to non-weight regulations (e.g., PCV violations, HTA violations excluding weight offences, etc.)

APPENDIX 2
CAUTIONS AND LIMITATIONS

CAUTIONS AND LIMITATIONS

As indicated in the Executive Summary, there are five major areas where limitations in the data exist and where caution should be exercised. These areas are discussed below.

1/ HISTORICAL REPORTED VIOLATION RATES

The historic records of vehicles examined and violations reported provide a rough indication of violation rates. The definition of a "violation rate" is not consistently established among station inspectors. In some instances the number of trucks inspected is used as a base.

In other instances, however, the number of trucks entering an inspection station is used. This would distort the true picture of non-compliance. With respect to the "inspected" trucks, some trucks are given a very cursory examination due to high volume and insufficient manpower.

2/ TRUCK VOLUME

Truck volumes were used in this study to derive district non-compliance estimates from individual sites. In most instances, estimates of truck volume were obtained from the existing MTC data sources. The values used were actually estimates based on systematic samples of existing traffic flows. Counts are only taken once every three years. It would be desirable to have more 24-hour classification counts in future data collection programs. Extensive continuous counting may, however, be both unmanageable and prohibitive in cost.

3/ TRUCK STATION CHARACTERISTICS

The information on truck station characteristics was collected from a previous year (1978). The 1978 truck survey was limited to 37 truck inspection station locations, did not cover all of the highways in the province, and the sample size at some stations was small. It would have been preferable to use up-to-date information. Obtaining this information, however, is a costly process. It is suggested that improving and updating this information should only be done where a specal need is identified.

4/ ESTIMATING METHOD

In order to improve the non-compliance estimate, additional thought should be given to the selection of sites in future studies.

The 24 sites for the special surveys at the truck inspection stations were selected in consultation with highway carrier staff. All regions in the province were represented. The survey locations were not distributed evenly across the province, however. Central Region was selected for a higher representation in the sample because this is where most of the trucking activity in the province occurs and where it is most difficult, due to the high volumes, for the inspection staff to examine a high proportion of vehicles. Reduction of time and travel costs were additional reasons for concentrating more on the Central Region than on the more remote locations. It would be desirable to have more survey observations from the Northern and Northwestern Regions to strengthen the non-compliance estimates.

The 23 mobile sites, selected in consultation with the district inspector in each district, were all located in southern Ontario. It was felt that in northern Ontario most of the highways are adequately covered by permanent inspection stations since the number of alternative routes between major destinations is limited. In future studies, however, it would be desirable to have more survey observations from mobile sites throughout the province, including northern Ontario.

5/ BYPASS SITUATION

In this study, an attempt was made to determine the extent of the bypass problem. Due to the time and cost constraints, only a few sites were selected for examining the bypass situation, thereby making it difficult to extrapolate the findings to the district, regional or provincial level. An in-depth investigation of this problem would be desirable, but very costly and time consuming.

APPENDIX 3
SURVEY DETAILS

SURVEY DETAILS

1/ SPECIAL SURVEYS AT TRUCK INSPECTION STATIONS

Following the discussion with staff and observations at the truck inspection stations, it was decided to conduct special surveys at a number of truck inspection stations. Twenty-four sites were selected in consultation with highway carrier staff.

Selected inspection stations on the highway system were requested to institute special procedures for approximately six shifts during the regular schedule of July, August, September and October. The shifts were selected to cover the days of the week and the hours of the day.

Additional manpower was required in addition to the normal station crew. The schedule was set in consultation with each district, and took into account vacations and other factors.

The final schedule was modified by the district inspectors due to court appearances, the factors previously noted, and other manpower scheduling considerations. The additional manpower for the six shifts was obtained by reducing the staff at adjacent stations or temporarily closing them for the six shifts.

The procedure involved the thorough inspection of every 'nth' truck that entered the station, whether it was empty or not, for example, every 10th truck. All trucks were counted by the first inspector, outside on the platform. He waved nine trucks by and stopped the 10th, which he directed to the scales in front of the station building. The second inspector weighed the truck and directed it forward to the third inspector (and in the high volume stations the fourth and fifth inspector) who checked papers. If the truck had a violation, the driver was directed to the parking area while the charge was written up.

Prior to the six shifts of operation a one-hour pilot study was undertaken by the consultant and regular station crew so that the procedures were well known and the inspection rate finalized.

The inspection rate "n" was finalized during the pilot study. It was expected that two rates would be used: a lower rate for the peak daytime hours (07:00 to 19:00) and a higher rate for the off-peak hours, (19:00 to 07:00). The rates were set for each station, bearing in mind the station traffic pattern.

The number of inspections and violations were recorded on special forms, and the same form was used throughout July and August to record hourly violations. This avoided confusion caused by using different forms.

2/ MOBILE INSPECTIONS ON OTHER ROUTES

The mobile inspections were carried out on major truck routes which do not have inspection stations. Sites considered to be key locations where truck activity is present were selected in consultation with the district area inspectors. The sites were chosen at suitable locations, such as at abandoned gas stations or sections of road with wide shoulders, so that trucks could be safely flagged off the road for inspection. Approximately five crew members were required for three shifts for each location. The staff consisted of area inspectors with two cars, supplemented by station inspectors. The shifts were scheduled in consultation with the district managers and inspectors.

An hour (or two-hour) pilot study was undertaken with each district crew. The three shifts at each location (six 3-hour periods) were scheduled in advance, similar to the inspection station schedule. The sites were chosen in pairs so that the crew could set up in one location for 3 h in the morning and in a second for 3 h in the afternoon.

The procedure at the sites was similar to that previously described for inspection stations. Every 'nth' truck was flagged over by the first officer, stationed with his car in advance of the inspection sites. The inspectors would judge by the tires, springs, etc. if the truck was overweight and only weigh it if necessary.

3/ SURVEY OF BYPASS TRAFFIC

Six stations were selected for monitoring the bypass traffic: Gananoque North and South, Lorne Park, Oakville, King and Woodbridge.

An estimate of truck traffic bypassing selected stations was made by truck counts and licence plate traces. The ramps immediately prior to and after the selected stations were monitored. The number of trucks and their licence plates and descriptions, leaving the highway prior to the station and entering the highway after the station, were recorded. This was done two hours before and two hours after the station opened. The difference in truck movements indicated the bypassing traffic. This survey was conducted by the regional traffic offices.

The day of the survey was selected in consultation with the schedules of the respective districts and co-ordinated by the consultant with the regional traffic engineers. Two traffic technicians (summer students) were required at each of the stations for 4 h each.